Techno India NJR Institute of Technology

Course File

Distributed System (6CS5- 11)

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Department of CSE

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year-VI Semester: B.Tech. Computer Science and Engineering

6CS5-11: Distributed System

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**

2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	01
2	**Distributed Systems:** Features of distributed systems, nodes of a distributed system, Distributed computation paradigms, Model of distributed systems, Types of Operating systems: Centralized Operating System, Network Operating Systems, Distributed Operating Systems and Cooperative Autonomous Systems, design issues in distributed operating systems. Systems Concepts and Architectures: Goals, Transparency, Services, Architecture Models, Distributed Computing Environment (DCE). Theoretical issues in distributed systems: Notions of time and state, states and events in a distributed system, time, clocks and event precedence, recording the state of distributed systems.	06
3	**Concurrent Processes and Programming:** Processes and Threads, Graph Models for Process Representation, Client/Server Model, Time Services, Language Mechanisms for Synchronization, Object Model Resource Servers, Characteristics of Concurrent Programming Languages (Language not included).Inter-process Communication and Coordination: Message Passing, Request/Reply and Transaction Communication, Name and Directory services, RPC and RMI case studies	05
4	**Distributed Process Scheduling:** A System Performance Model, Static Process Scheduling with Communication, Dynamic Load Sharing and Balancing, Distributed Process Implementation. Distributed File Systems: Transparencies and Characteristics of DFS, DFS Design and implementation, Transaction Service and Concurrency Control, Data and File Replication. Case studies: Sun network file systems, General Parallel file System and Window's file systems. Andrew and Coda File Systems	06
5	**Distributed Shared Memory:** Non-Uniform Memory Access Architectures, Memory Consistency Models, Multiprocessor Cache Systems, Distributed Shared Memory, Implementation of DSM systems. Models of Distributed Computation: Preliminaries, Causality, Distributed Snapshots, Modelling a Distributed Computation, Failures in a Distributed System, Distributed Mutual Exclusion, Election, Distributed Deadlock handling, Distributed termination detection.	06
6	**Distributed Agreement:** Concept of Faults, failure and recovery, Byzantine Faults, Adversaries, Byzantine Agreement, Impossibility of Consensus and Randomized Distributed Agreement. Replicated Data Management: concepts and issues, Database Techniques, Atomic Multicast, and Update Propagation. CORBA case study: Introduction, Architecture, CORBA RMI, CORBA Services.	05
	Total	28

Course Overview:

The course will help the students to have knowledge of the basic elements and concepts related to distributed system technologies, core architectural aspects of distributed systems, design and implement distributed applications, the main underlying components of distributed systems (such as RPC, file systems), use and application of important methods in distributed systems to support scalability and fault tolerance, and distributes file systems.

Course Outcome:

6CS511	Cognitive Level	Distributed System Year of study: 2020-21
1	Knowledge	Understanding the basics of distributed systems along with associated applications and research issues
2	Knowledge	Understanding the features, models, design issues, logical clock and event precedence
3	Knowledge	Understanding of concurrent process, inter-process communication and its characteristics, RPC and RMI
4	Knowledge	Understanding of system performance model, static process scheduling, dynamic load balancing, DFS
5	Knowledge	Understanding of distributed shared memory , faults, recovery and replicated distributed agreement

CO PO Mapping:

c															
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO36511.1	1	3	0	0	0	0	0	0	0	0	0	0	3	2	2
CO36511.2	1	2	2	0	0	0	0	0	0	0	0	0	3	2	1
CO36511.3	1	0	2	2	1	0	0	0	0	0	0	0	2	1	1
CO36511.4	1	2	2	0	1	0	0	0	0	0	0	0	1	1	1
CO36511.5	1	3	0	0	0	0	0	0	0	0	0	0	2	2	1
C36511 (AVG)	1.00	2.00	1.20	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	1.60	1.20

Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	Objective and Concept of Distributed Systems , and how are they different from centralized systems
2	1	Applications and research issues of distributed systems
3	2	Consequences and features of distributed systems
4	2	System architectures
5	2	Design requirements
6	2	Interaction, secure and failure models
7	2	Time and state, clocks, event precedence
8	2	Lamport's algorithm and limitations
9	3	Process and thread
10	3	Concurrent processes
11	3	Inter-process communication and features
12	3	(i) message passing (ii) Request/reply and transaction communication (iii) group communication
13	3	RPC - Concept, design issues and call semantics
14	3	Concept of RMI
15	4	System performance model – speedup mathematical representation
16	4	Static load sharing, dynamic load balancing
17	4	Transparencies of Distributed Files Systems (DFS)
18	4	Characteristics of Distributed Files Systems (DFS)
19	4	NFS protocol and remote operations
20	4	(i) caching and remote service (ii)cache update policy (iii) cache location – disk vs memory (iv) stateless and stateful file service
21	5	non-uniform memory access architecture
22	5	(i) memory consistency models (ii) multiprocessor cache systems
23	5	distributed shared memory and implementation issues
24	5	(i) distributed mutual exclusion (ii) election in distributed systems
25	5	distributed deadlock handling and distributed termination detection

26	6	faults and recovery in distributed systems
27	6	Byzantine faults
28	6	Byzantine agreement and randomized distributed agreement
29	6	concepts and issues of replicate data management
30	6	atomic multicast and update propagation in context to database techniques

Text Book –

George Coulouris, Jean Dollimore, Tim Kindberg , "Distributed Systems – Concepts and Design", Pearson Education Ltd.

Course Level Problems (Test Items):

CO.NO.	Problem description
1	A. What do you mean by distributed systems? How do they differ from centralized systems? B. What are the applications and research issues of distributed systems ?
2	A. What are the consequences of distributed systems in context to concurrency, no global clock, and independent failures? B. Comment on hardware and software service layers in distributed systems
3	A. Define process and thread. What are the graph models for process representation? B. Explain context switching as a result of inter-process communication
4	A. What do you mean by system performance model? Represent mathematically the speedup, ideal speedup and speedup degradation. B. What are the transparencies and characteristics of distributed file systems (DFS)?
5	A. Explain non-uniform memory access architecture B. What are the models and causality in distributed systems?

Assessment Methodology:

1. Assignments one from each unit.
2. Midterm subjective paper where they have to write algorithms to perform different operations on different data structures as mentioned in the modules. (Twice during the semester)
3. Final paper at the end of the semester subjective.

SUPPORTING STUDY MATERIAL LINKS:

1. https://nptel.ac.in/courses/106/106/106106168/
2. https://www.digimat.in/nptel/courses/video/106106168/L01.html
3. https://www.youtube.com/playlist?list=PLeKd45zvjcDFUEv_ohr_HdUFe97RItdiB
4. https://learning.edx.org/course/course-v1:KTHx+ID2203.1x+3T_2017/home

Previous Year Question Paper:

8E8163

Roll No. _____ Total No of Pages: 2

8E8163

B.Tech. VIII-Sem (Main & Back) Exam September 2020

Computer Sc. & Engg.

8CS3A Distributed Systems

Time: 2 Hours **Maximum Marks: 48**
Min. Passing Marks: 16

Instructions to Candidates:

*Attempt **three questions,** selecting **one question each** from any three **unit.** All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT- I

Q.1 What are the differences among Cluster computing, Grid computing and Cloud computing? Explain. [16]

OR

Q.1 (a) What is Distributed system? What are the basic features of distributed system? [8]

(b) Explain Distributed computing and its Paradigms. [8]

UNIT- II

Q.2 (a) What do you understand by 'Language mechanisms for synchronization'? [8]

(b) Where do you need RPC? Explain with a suitable example. [8]

OR

Q.2 (a) Can a server work as a client and a server in a system? Explain. [8]

(b) Is there any difference between vertical and horizontal fragmentation? Explain. [8]

UNIT- III

Q.3 (a) Describe the file service architecture. Explain case study on sun network file system. [8]

(b) Differentiate between flat and nested distributed transaction. Explain concurrency control in distributed transaction. [8]

OR

Q.3 Write short note on:

(a) General Parallel File System and Windows File System. [8]

(b) Andrew and Coda file systems. [8]

UNIT- IV

Q.4 (a) Explain distributed shared memory system in distributed environment with suitable diagram. [8]

(b) Explain the failure in a distributed system. [8]

OR

Q.4 (a) Explain distributed mutual exclusion with its classification. [8]

(b) Describe memory consistency models & multiprocessor cache systems. [8]

UNIT- V

Q.5 Explain the concepts of relocation, migration and failure transparency. [16]

OR

Q.5 Write short notes on any two: [2×8=16]

(a) Byzantine Agreement

(b) CORBA Services

(c) Randomized Distributed Agreement

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